The American Biology Teacher

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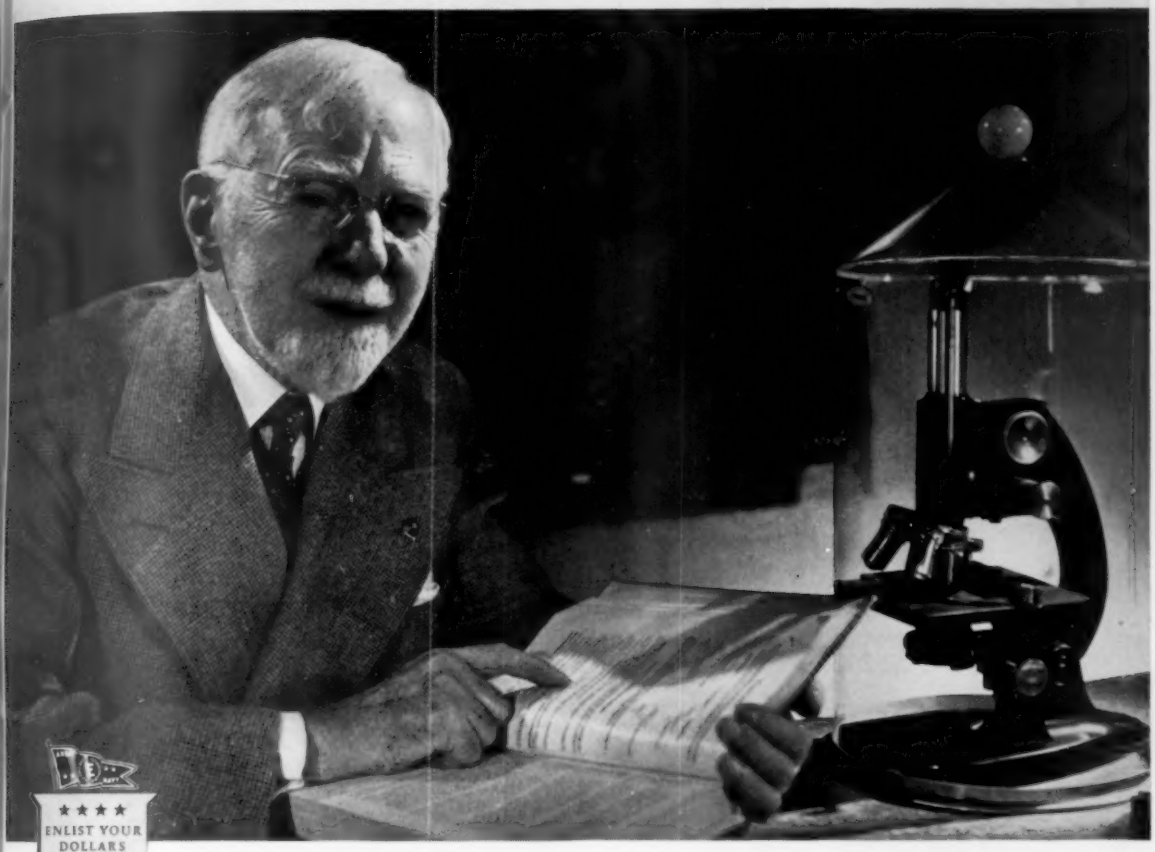

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The American Biology Teacher

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The Science of Biology and the Future of Man*

A. J. CARLSON
Emeritus Professor of Physiology, University of Chicago

The title for my discussion is too formidable for me and I believe for every other biologist, that is, if we propose to stick strictly to the known and the probable. However, I think the fundamental issue before us is *the significance and the service of the science of biology in man's future biologic, social, and economic development.* And that raises another fundamental question. I think we are all agreed on this point: *understanding should be a significant factor for tomorrow's man, both for him as an individual and for him as an effective factor in the social environment.* The only question is: to what degree is it possible to bring this about? That is primarily a question of development of control by the higher centers of our nervous system, that is, the cerebrum, over the primitive or lower center of the brain, the hypothalamus. For biology of subhuman species and the history of man to date shows that human actions have been determined more by the emotions and the hypothalamus, than by understanding and reason based thereon.

I think at this point we biologists should be more than ready to confess that our science today and more so tomorrow depends on our sister sciences, chemistry and physics. We advance or fall together. It is perfectly true that the old style descriptive biology, classification of species, etc., can be accomplished with little or no background or understanding of either chemistry or physics; but functional biology (dynamic biology), as it has developed in the last 50 years and as it will further develop tomorrow, is very intimately dependent on parallel developments in the physical sciences. It is functional biology which constitutes and determines the behavior of man. This is the more difficult phase of biology. This is the field of biology filled with most of the

* Abstract of address before the NATIONAL ASSOCIATION OF BIOLOGY TEACHERS, Cleveland, Ohio, September 16, 1944.

unknowns, the gaps, and the guesses. But we, the teachers in this field, must obviously master the known and somehow present it to our students, children and adults, in such a way if possible, that the *understanding of the human machinery in health and in disease becomes a dynamic factor in human behavior*. What I have said so far seems, to me at least, obvious. That we have not achieved this goal up to the present most of you will agree. When it comes to the question of how we can more rapidly approach this goal, there will probably not be an equal unanimity of views and opinions among us.

In a recent national survey of the teaching of biology in the nation's high schools, under the direction of Dr. Oscar Riddle of the Carnegie Institution, the conclusion was reached that a deplorable percentage of the teachers of biology in our high schools were poorly equipped to perform this function in a manner demanded by the needs of man. There are probably not enough superior teachers to go around either in biology or in any other field of education, knowledge, and training. As an excuse for this condition is frequently offered the fact of the over-all low salaries of high school instructors attracting too few superior men and women into that field. This may be so but I seriously doubt that those men and women who understand the necessity for and the fundamental role of teaching, those people who would rather do or try to do this kind of service than any other thing, that these people are deflected from such courses by a difference in remuneration of a few hundred or a few thousand dollars a year. It is, of course, true that the social status or prestige of any man or woman in our society is, unfortunately, determined so largely by the yardstick of salary and material wealth. Where this view prevails the high school teacher becomes an insignificant member of society indeed. But the conviction that we are performing an essential and significant task should outweigh all other consideration, and ultimately society will recognize our important work.

There can be little doubt that for the fullest realization of the significance of biology for the future of man there must be much more serious consideration given in the high school curriculum to human biology than is the case at present. Much more fundamental attention must be given to the essentials of human biology in the training of the teachers for high school positions in this field throughout the land. In a recent study of the impact of all the natural sciences on the college freshman in 16 central states, including Ohio, I found according to the measures used that psychology and chemistry came first, zoology third, and human biology last or eighth. This relation probably reflects the situation in the high school if not as to time in the curriculum, at least as to the scientific quality of the teaching. I think you will agree that by tradition and regulations, there is a disproportion in the amount of attention given to the ten thousand more or less useful facts as against efforts towards understanding of the fundamentals that may guide man's judgment and actions as to food, health, and behavior towards his fellow men.

Before entering on my last topic, I should like to make these two points, as it were, in passing: I. The teacher of biology in our high school should gain some courage, confidence and ambition from the well-known fact that for two-thirds of his pupils the high school teaching of human biology is all the formal aid to the understanding of human biology that these boys and girls will ever receive. And even those high school graduates who later enter college may go through the entire liberal arts college

course without further exposure to the important fundamentals of human biology, in health and disease. II. The above point which I think nobody can question raises a further problem. Namely, that of the urgent need in our country of adult education in the fundamentals of human biology. It is, of course, a fact that education is never completed. New developments in human biology, health, and disease go on at an accelerating pace in our times. Many adult fellow citizens never entered or completed even their high school education. Most of the adult education in human biology now prevailing in our land is through advertising of foods, drinks, vitamins and other remedies by concerns primarily interested in greater sale of these products. Such advertising in the press and over the radio too frequently assumes the form of such skillful weaving together of facts and fancies as to be called artistic lying. Should we not consider the possibility of making every high school in our land the center for well-conceived and well-directed evening courses for adults in fundamental human biology? Such courses could be directed, and I believe would be directed, by our best teachers, even without additional pay. Visual aids to such adult education such as slides, motion pictures, suitable reading materials are available. We should not be discouraged by small registration to begin with, because serious educational efforts are in competition with entertainment in motion pictures and radio and at the start come out second best.

Human biology can no longer be taught effectively solely by aid of the materials in the formalin jar, supplemented by the best of books. Such effective teaching requires the aid of experiment and demonstration on living tissues, living organs, and living animals under anesthesia. In some states that type of teaching is prohibited or limited by law, in other cases it is limited or prevented by custom or social pressure. Some people do not yet admit that man is an animal. How are we to remove this handicap except, through more effective adult education in human biology?

So far I have said little about biology in its bearing on the future of man. This phase of my talk will be largely a series of questions:

I. All the present evidence indicates that the human beings now inhabiting the earth are one species, irrespective of their color and form. But this knowledge has not yet succeeded in eliminating the ancient and ever-recurring superstition or belief in this or that "superior race." We admit superior individuals and for varying times, superior families, but I know of no clear evidence of superior groups within the same species, given the same environment, food and educational opportunities. In many species below man it has been possible to breed, for specific forms, qualities and performance. Even if this was desirable for tomorrow in the case of man, it certainly has not been tried on a scientific basis up to date. So that, apart from the possibility of weakening our race of tomorrow by the survival of too many inferior or less fit individuals, it is a futile pastime to tarry long with the question as to what extent the growing knowledge and possible control of heredity will benefit our race in the future.

II. Can application of relative justice in national and international relations ever avert the (to me) insane destruction of the best in human lives and the value of products of human toil which prevail in war. I am well aware that even men and women who think (including some biologists) have held the view that war aids and improves the human race. There are others who take the opposite

view. All we can say is, *we have no controls.* And that raises the question, assuming we biologists are permitted to teach *what can we teach on this issue?*

III. Nearly every activity of man (social, political, industrial) has an impact on and frequently a limiting factor in the dynamic biology of man. Thus:

(a) In many industries we are face to face either with new chemicals injurious to man or with dangerous concentrations of injurious chemicals. I have said earlier and I repeat here that in our so-called civilized countries, through industry and science, man is being exposed to new chemical environments by virtually turning the earth inside out at the rate to which man and other species in the past were never exposed. The chemical poisons of our industrial civilization, what will they do over the centuries to our air, our soil, our waters, and our human frame? Will biologic understanding and increasing medical knowledge cope with this problem tomorrow?

(b) Urbanization and industrialization pose problems of housing and food, work and leisure, not present under the more primitive conditions which governed the greater span of man's evolution. This means that these phases of life become part of human biology tomorrow. Why not start studying them today?

(c) Man of the stone age appears to have gained fair control over most of the larger predatory species competing with him for the control of the earth and a place in the sun. But the stone hammer and flint spear head were poor weapons against the harmful and disease-bearing insects and perfectly impotent against the myriads of man's microscopic and submicroscopic enemies. Modern biology, today's preventative and corrective medicine have gained some control over these injurious and deadly hordes. That may spell better health, better mental and physical efficiency and more years of useful life for the man of tomorrow. But we cannot be sure of these results because new and injurious factors may sneak in, as it were, through the back door of our civilization. One of these factors may be greater malnutrition, as all species, man included, tend to multiply beyond the limits of available foods for an optimum diet. When the check on overpopulation by disease is checked by medical science, can and will men of tomorrow substitute understanding as a check on population increases beyond the conditions for optimum living? Or will they resort to war?

(d) The harder conditions of life in man's past and the virtual absence of scientific control of diesase until yesterday unquestionably resulted in the earlier elimination of the weaker and the less fit members of our race. How is that important function for the race to be taken care of by and for the man of tomorrow? We can not answer this question now, for the simple reason that we do not know how soon and to what degree man's action will be governed by understanding and the long view, rather than by the emotions of today and the taboos of yesterday.

(e) Assuming increasing control of infectious diseases and a decrease in the prevalence of war and a not too rapid weakening of the human race by the reproduction and survival of the less fit, it seems clear that food will some day be the limiting factor of our numbers, if not of our health and efficiency, no matter how much more understanding we may gain of the interior of the earth, of subatomic energy, and of the super galaxies in the distant heavens. *That means agriculture and foods are clearly must items in the teaching of human biology tomorrow. But why wait till tomorrow?*

Field Trips With A Long-Range Purpose

MARY D. ROGICK
College of New Rochelle, New Rochelle, New York

Everywhere about us lie practically unlimited sources of inspiration and interesting material upon which to draw to enrich our biology courses. Unsolved and intriguing problems by the score await the inquisitive and trained mind. A good, well-trained teacher will seek these out and use them to make biology the living, ever-expanding science that it deserves to be.

Living or preserved specimens are regularly studied in the biology schoolroom but there are rare occasions when the classroom is virtually transferred to the Great Outdoors, where exists an infinite variety of environmental conditions, plants and animals within a few minutes' walk of the school in any suburb or small community. Possibly the reason for the lesser frequency of this mode of teaching is that classes may be too unwieldy to handle in the field by one instructor, particularly if the class is large or composed of students with diverse interests or a lack of interest in biology.

A properly conducted and productive field trip requires more planning than a classroom recitation or laboratory period. The technique of conducting a field trip can be observed or learned most easily by attending a course or some summer biological stations where sufficient emphasis is placed on this form of biology training. The Invertebrate Zoology Course of the *Marine Biological Laboratory* at Woods Hole, Massachusetts, has for years given excellent training along this line. It has developed, over a period of years, a very effective field trip technique. The essentials of this technique, which is especially suited to collecting in certain marine habitats but which with a few modifications could be applied to collecting in other localities, are briefly as follows.

The class is divided into six teams composed of six to nine students per team. There is one instructor for each team. Each team is supervised by a different instructor on each field trip. Each team member has a definite task to perform. The accompanying figure shows the composition of such a team.

Individual *A* is the instructor, with somewhat more work to do than the figure indicates. He points out ecological associations, animal activities of special interest, helps students to identify the specimens found, indicates the significant differences between closely related species and directs the collecting activities of his team. After the trip he can be found in the laboratory, going over the "take" or "catch," identifying it more carefully and giving suggestions for the preparation of student reports on the results of the trip.

Individual *B* is the shovel carrier. Where it is possible to dig, he digs. Sand, mud, gravel and "peat" bottoms must be explored for a large variety of worms, mollusks, echinoderms and arthropods. Each shovelful of bottom is transferred to the sieve, held by Individual *C*. A sieveful of soft, fine-particled mud looks absolutely destitute of animal life until washed, whereupon many worms and mollusk shells become evident on the wire screen bottom of the sieve.

Individual *D* is the "Angel" or team's official secretary. His or her official duties are the recording of ecological notes on tide, weather conditions, temperature, abundance or scarcity of biota, description of collecting areas, listing of all species found and keeping track of which specimens were placed in

B C D E F G

A collecting team at work in a marine habitat. Individual *A* is the instructor, *B* carries the shovel, *C* the sieve, *D* the "angel book" or official record of trip, *E* the "ark," *F* the net, *G* the "see-bucket," *H* an assortment of instruments and bowl or pan.

the numbered bottles carried by the "Ark." The "angel" turns in the team's finished report to the instructor.

Individual *E* carries the "Ark" or temporary repository for collected specimens. Some of these animals will be identified under the compound or dissecting microscopes in the laboratory because in many instances field hand-lenses are inadequate for the finer taxonomic details. The "Ark" is nothing more than a wooden frame housing collecting bottles of assorted sizes. Animals are brought back alive for study.

Individual *F* carries a heavy short-handled dip net. He sweeps it over the sandy or muddy bottom, around rocks and among sea weeds. It catches the floating, swimming or unattached forms like jellyfish and crustacea.

Individual *G* carries the "see" bucket, which is provided with a glass bottom. It can be used for undisturbed observation of animals under several feet of water. With it one can see hermit crabs running about on the sea bottom, the tips of protruding worm tubes, worm and mollusk holes, etc. After locating a particularly promising bottom area the "Shovel" is called over to dig.

Individual *H* carries a miscellany of things such as pipette, Syracuse watch glass, finger bowl, white enameled pan, forceps, etc. From sea weed when washed in a pan of water can be obtained numerous arthropods and mollusks, small forms which are protectively colored, which cling tenaciously and which would otherwise escape notice.

On some field trips other items of individual equipment are required but the above are sufficient for most aquatic shore trips. Each team member is responsible for the return of his particular equipment. The duties of each individual are rotated on successive field trips so that every person has an opportunity to do every team duty before the course is over. Before each trip the team is provided with a mimeographed map of the collecting region, with the collecting stations or areas clearly indicated. It also receives a check-list containing the scientific names of some 336 species of animals which have been most often collected by previous Invertebrate classes and more than one-third to one-half of which number would very likely be collected on any single trip of the class.

For a high school or college class of 24 to 36 students having one instructor this field trip plan would require modification. The teams might be made larger and one or two of them headed by de-

partmental majors or older students who had been previously taken on a preliminary or refresher trip by the instructor. The more planning and preparation that is done before the trip is actually under way the smoother will be the conduct of the trip.

Outdoor biological field trips might be grouped into several categories:

1. The *general observational* type of field trip,
2. The specific *ecological problem* type,
3. The *species collection* or *identification* type.

The first type refers to taking students out of doors to see plants and animals in their natural habitats, to make observations of a rather general nature and usually without much plan or purpose.

The second type refers to field trips which are conducted for a more specific purpose like making an intensive study of one species of plant or animal or of a definite habitat or association and subordinating or relating other biotic factors to that particular chosen one.

The third type refers to those field trips whose purpose is to identify or collect as many plants or animals as can be found by diligent search. Bird walks, identification of common trees, shrubs, grasses, flowers, etc., would come under this category.

After these things have been accomplished the average teacher might be tempted to call it a job well done. However those trips could have greater value to the teacher, student and the community if they were made part of a long-range biological program.

By a long-range biological program is meant some well-organized purposeful plan which requires several years and the coordinated work of a number of successive biology classes for its completion. For example, if one's school is located near a lake, pond, river, creek, slough, swamp, marsh, seashore, woodland, cave or mountain that locality could be made the subject of an intensive year-to-year and seasonal study. This program would not perhaps be feasible for a school in the midst of a large city but would lend itself nicely to schools in small communities or others less centrally located. The study could be divided into the following parts:

Part 1. Description of area under investigation.

Part 2. Collection of animal and plant specimens in that area.

Part 3. The keeping of permanent records.

Part 4. Formulation of problems utilizing the foregoing information.

Part 1. A very complete ecological description of the area or site chosen for class research might include such things as maps, photographs, descriptions of geological, geographical and biotic features, what chemical data is possible or suitable in the area as pH, dissolved O_2, CO_2, etc. (for which one would probably have to call on the Chemistry Department for aid). This part could well be the field work of one year's class. The data obtained should be permanently recorded in either a bound notebook or on index cards and carefully filed so that it would be readily accessible to succeeding classes and possibly succeeding biology instructors.

Part 2. Samples of all plants and animals normally occurring in the chosen area should be collected for the school museum. This should include embryonic, larval and adult stages wherever possible. The plants could be pressed (and some preserved otherwise), while the animals could be preserved in the manner most suited to the specimen. Mollusk shells, insects, sponges, mammals, worms, etc., would require different preparation methods. The mode of preservation or preparation of specimens could well be made a project for a

second biology class. The specimens in the collection should be numbered, correctly identified and card indexed. On the index card should be data giving the scientific name, date of collection, dates of occurrence, collecting sites, scarcity or abundance of specimens, size, type of homes if species is a home-building kind, food, enemies and any other life-history data. This museum collection could be studied each year by classes with a view to adding new forms to the museum list by diligent collecting. Also, preliminary acquaintance with the forms common to an area would leave students freer to make ecological observations on those in the field. If any changes have taken place in the relationship between various plants and animals due to normal biotic succession, to climatic factors like storms and weather extremes, or to man's intervention (like forest fires, pollution, clearance of areas, and introduction of non-native plants or animals) those would have far more significance to the student if he can refer to older records of the locality before these factors had begun to operate. This museum collection would be a fine way of interesting the neighborhood or the community in the biology course.

Part 3. Careful thought should be given to the keeping of records because once a system is adopted it should be followed with reasonable consistency. The school or town librarian might offer many helpful suggestion as to size of cards, filing methods and organization of the mass of data that is bound to accumulate if the project is to be continued for any considerable length of time. In keeping records over a period of time it is necessary that each season's or year's records be properly dated, timed, notice taken of climatic factors or any changes that have taken place. Since memory is such a faulty and incomplete thing the aim should be to record as much data as possible in readable and permanent form.

Part 4. The collection of pressed plant and preserved animal specimens could serve as a nucleus for a number of projects and problems. For example, students could be assigned (a) the task of making life-history mounts or demonstrations utilizing such stages of animals or insects as they can find, (b) a single species of plant or animal to look up, draw and write up in as much detail as the limited library facilities will permit. If these reports were done on standard-sized paper or index cards and different species were assigned to the various students, then, after a few classes had turned in their reports and drawings a fairly respectable number of species would be written up and illustrated. In this way each class would be adding to the work of the preceding classes according to a definite, well-thought-out plan. This would give students an inkling of how scientific knowledge is accumulated, how records are kept, how specimens can be preserved, what changes occur from year to year and practice in identifying species (to a limited degree). Not only would it be of interest to the immediate class but also to those who had had a part in it in past years. The latter would very likely retain more interest in biology if they knew that their work was being continued and elaborated upon by others.

If the work had been carefully planned, write-ups and records standardized, material neatly prepared, specimens preserved in containers of a few standard sizes rather than in any type of bottle momentarily at hand (if animal), or pressed on durable, good quality uniform-sized herbarium sheets (if plant), then some effort should be made to display specimens, records and demonstrations in as attractive a manner in the biology laboratory as is possible.

A long-range program would be desirable for many reasons. It would:

1. Bring a sense of continuity and usefulness to the course;
2. Bind the school more closely to the community;
3. Be a worthwhile investigation of one phase of community life;
4. Be excellent biological training for both student and teacher;
5. Be a genuine research project parts of which might lend themselves to publication.

In a community which is fast becoming industrialized or urbanized such records would be valuable, interesting and ever-changing. They could give students and the community an awareness of the effect of changing conditions on the biology of the region and an appreciation of the rightful place of biology in the life of the community.

Rearing Tree-Hole Organisms in the Laboratory

JOHN B. GERBERICH
Ohio State University, Columbus, Ohio

Tree-hole habitats may be formed by the decaying of certain portions of the tree, leaving a cavity which will hold water for sufficient time that animals and plants will establish themselves. Throughout our woods and orchards these tree-holes may be found. Within such habitats one may find arthropods, such as flies, mosquitoes, spiders, beetles, bugs and ants; protozoa such as paramecium, amoeba, euglena and vorticella; flatworms; roundworms; earthworms; many kinds of bacteria, fungi, algae and mosses. If the tree-hole is brought into the laboratory, it requires little attention and space and offers the student opportunities of observing many biological principles. These are related to structure, locomotion, nutrition, respiration, photosynthesis, excretion, behavior, growth and development, heredity and reproduction. Such a habitat can be of convenient size so that the effects of different ecological factors such as light, temperature and humidity may be studied under controlled conditions.

The rearing of tree-hole organisms in the laboratory may be attempted by two methods; first, by creating a habitat as similar as possible to the natural breeding place, and second, by transferring a natural breeding place into the laboratory. The former method involves the laborious efforts of setting up a wooden container, finding and transporting the flora and fauna and establishing that material which may be desired. It is believed that the latter method of rearing tree-hole organisms can be easier set-up for study in classrooms of high schools, colleges and universities.

After a tree-hole is located it may be sawed from the remaining portion of the tree to fit the available transportation into the laboratory and at the same time it may be trimmed to a size that can be accommodated in the laboratory. Tree-holes are found in nature to vary in size from those which would require a truck for transportation, to those which can be carried in an individual's arms. It may be necessary to stop some of the leaks caused by vibrations and disturbances in handling the tree-hole, so as to maintain a desired water-level. This can be accomplished in several ways;

first, if the seepage is not too great the tree hole might be placed on a base of five or six inches of ground in a wooden frame; second, if the wood is partly dried the bottom portion may be painted with melted paraffin; and third, the combination of the above methods.

In order to keep the flying insects under control it is necessary to close both ends of the log. A towel may be pinned over the back end and a cage (Fig. 1) built around the open end with four sides covered with cheese-cloth, the bottom resting tightly upon a table or ground filled frame and the top covered with a glass plate.

A cloth sleeve-type opening could be made in one of the sides of the cage to allow entrance for work. This opening is made by fastening one side of the cage to another piece of cheese-cloth by an embroidery ring. The center of the embroidery ring is cut out leaving a sleeve covering which can be slid up and lightly wrapped about the arm to prevent escape of the animals. To close the cage, the cheese-cloth sleeve is pulled out straight and rolled up. This roll can be placed on the inner lip of the embroidery ring as seen in Figure 1.

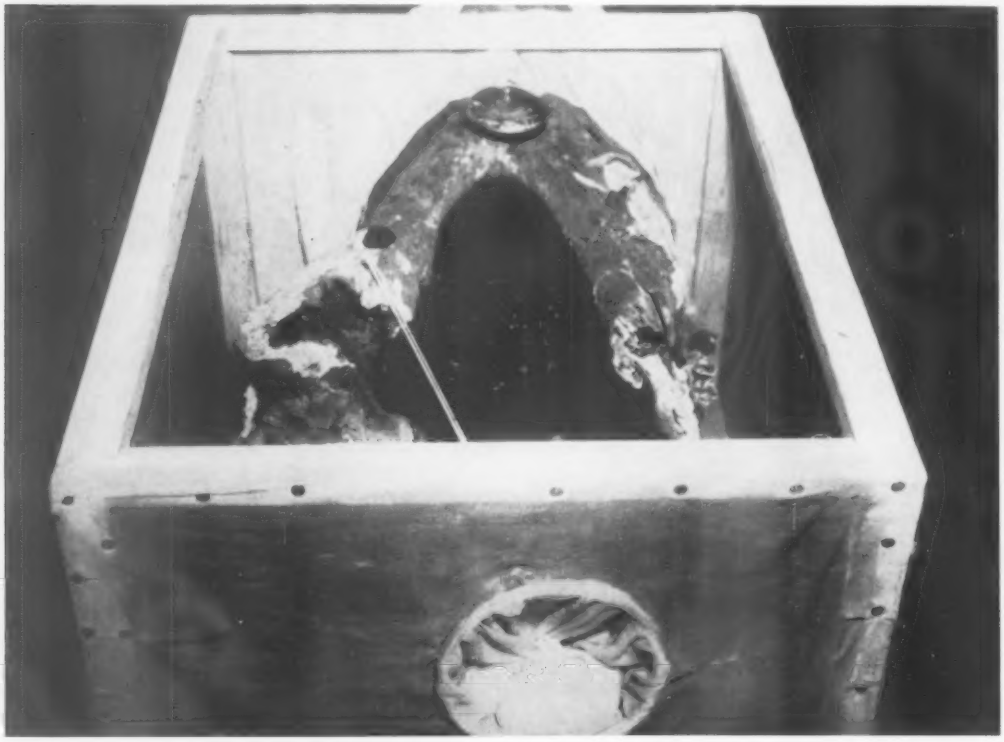

FIG. 1. Cage for rearing tree-hole organisms in the laboratory. Sides covered with cheese-cloth, top with glass. Box built large enough to accommodate the portion of the tree required.

The rate of evaporation may be controlled by painting melted paraffin (Summer paraffin) on the cheese-cloth sides and hanging wet towels inside of the cage. Light bulbs can be placed inside of the cage and through the pinned towel in the rear of the log for illumination. If higher temperatures or changes in the temperature are desired, this can be regulated by different sizes of electric light bulbs. Appropriate food for the organisms under cultivation can be

placed in or around the log. Prunes and a Petri dish of honey, as can be observed in Figure 1, are used as food for adult mosquitoes and other insects.

If a study of the development of the eggs and larvae of these tree-hole forms is desired it is necessary to furnish some material which would be satisfactory to the organism for egg laying. For studies and demonstrations involving small samples and the rearing of these larvae a wooden block with a cavity (Fig. 2, B) can be employed. When larger populations are desired a wooden bucket (Fig. 2, A) can be handled very satisfactorily. Whether the wooden block or the bucket is used the cavity is filled about two-thirds full of distilled water and placed in the cage.

The devices just described can be used in individual problems or on an elementary basis to demonstrate some of the biological principles. Ecological principles such as biotic potential, succession, resistance to environment and range of tolerance can be easily demonstrated. Types of behavior as solitary life, community life, gregariousness, commensalism and symbiosis are continuously going on within a tree-hole. Many different kinds of feeding habits such as omnivorousness, carnivorousness, herbivorousness, cannibalism, predaceousness and scavenging can be observed at almost all times.

FIG. 2. Equipment for artificial duplication of tree-hole habitat.

BIOLOGY TEACHERS CLUB OF SOUTHWESTERN PENNSYLVANIA

The subject for the November meeting was *Visual Education* with Mr. S. O. Kegley in charge. The meeting was preceded by a dinner at the Schenley Coffee Shop.

At the time of the meeting the club had sixty-seven paid up members. An interesting and perhaps unique feature among locals is the monthly publication of *Biology Notes*, a two to four page mimeographed paper on interesting biological facts and teaching aids. The club also publishes an attractive little year book, with a complete list of members, officers, committees, and tentative programs.

The officers are as follows:

President: Elizabeth McClelland.
First Vice President: Harry S. Wieland.
Second Vice President: Carsten Ahrens.
Secretary: Janette Dickson.
Treasurer: Elmer G. Thumm.
Editor: Edna Higbee.

A LETTER FROM SOMEWHERE IN BELGIUM

Dear Miss Evans:*

Enclosed is a M. O. for $1.50 for a subscription for membership in the National Association of Biology Teachers. Prior to my entry into the army, I had started to teach biology in a Chicago High School. Now, after reading your paragraph in the "University of Chicago Magazine," I would like to receive The American Biology Teacher to help me keep in contact with the field. Thank you very much.

SGT. DAVID H. HELLER
Med. Det. 1 Bn., 60 Inf.
APO 9, c/o P. M., New York

* Wisconsin chairman of membership committee.

NEXT MONTH: *Chemical Gardening in the High School*, a full length article, complete with illustrations, formulas, table of experimental results, and student reference list.

Editorial Comment

When the editor addresses a letter to his readers he is almost certain to mention sooner or later that, after all, the journal belongs to the readers. This trite old statement is so frequently made because it is, after all, true. What the editor of a journal such as ours finally puts in or leaves out is determined most of all by what he thinks the readers want.

Most of the subscribers of THE AMERICAN BIOLOGY TEACHER are high school teachers, as are a majority of the members of the editorial staff. High school teachers have regularly contributed more of the published articles than have any other group. For example, in *Volume 6* they provided about 45% of the articles, college teachers about 20% and all others (including science supervisors, city, state and national officials, physicians, etc.) about 35%. While the exact percentages have varied from year to year, these figures are somewhere near the average for the entire life of the journal. So this is mainly a high school teachers' magazine.

What do these teachers want? Almost everything, it seems. There is a general group preference for "practical" articles, teaching aids, short reviews, illustrations, reference sources, formulas, and other items that can be put to immediate use in the classroom, but some readers want technical papers, philosophy of biology, principles of education or research, so the editor tries to balance the percentage of the latter type of articles with the demand for them. If he guesses wrong it is because he does not have a sufficiently accurate method of estimating reader preferences.

An important function of our kind of journal is to serve as a medium of expression for teachers who have had no previous experience in writing for publication. Some of our best articles come from this group. The inexperienced author may be full of brand new ideas and enthusiasm to go with them. The fact that he has never had anything published before is quite unimportant. If you are one who "never could write," but have an idea that you think is worth something, write it up and send it to any one of the editorial staff. If it "has something" the editors will help you to put it into correct publication form. If your manuscript should be impossible, (this is seldom true), you will be told exactly why so you can try again. Every manuscript submitted receives careful consideration. When you get ready to write up your article, it may be well to consult *Preparation of Manuscripts for Publication.**

When one of our articles strikes you as especially good or especially bad drop us a line telling us why you like it or why you don't like it. If there are features you would like to see added to our present offerings let us know what they are. Don't forget to mention THE AMERICAN BIOLOGY TEACHER when you answer one of the advertisements appearing in the journal. And get a couple of new subscribers.

Once again—yours for a successful and useful year for THE AMERICAN BIOLOGY TEACHER.

JOHN BREUKELMAN

* THE AMERICAN BIOLOGY TEACHER, October 1943, pp. 20–24. A limited supply of reprints is still available. Copies may be obtained from the editor.

A Visual Education Project

ROY JAMES WATSON
London Public Schools, New London, Texas

In the scientific classification of butterflies, knowledge pertaining to the venation of the wings is absolutely necessary. However, the identification of the most common butterflies may be made into an excellent study in a visual aid project. This practice has arisen in various high school classes of biology. Generally the student is interested in the name and habits of butterflies and attempts to name his specimens by comparison with pictures in books. While this practice is not an accepted scientific method, it fulfills a much needed practice of inspiring students to investigate further into the field of biological science. The preparation of slides showing the veins in butterfly wings uses the following apparatus and chemicals: a few square inches of window glass, glass cutter, sheets of very thin cellophane, cellophane tape, balsam, alcohol, hydrochloric acid, xylol, and sodium hypochlorite (chlorox).

The following method was successfully carried to completion: first, remove the wings carefully so as not to break the frenulum (spine); then dip the wings in thirty-five per cent alcohol in order to wet them. Immerse the wings for an instant in hydrochloric acid, one part acid to nine parts water. This is not always necessary. The next step in this method of bleaching wings is to put them in sodium hypochlorite and leave there until the color has been removed from the scales. If a wing bleaches slowly, the process can be hastened by dipping the wing in the dilute acid and returning it to the sodium hypochlorite from time to time.

FIG. 1. Butterfly genus *Anaea*. Photo by the author.

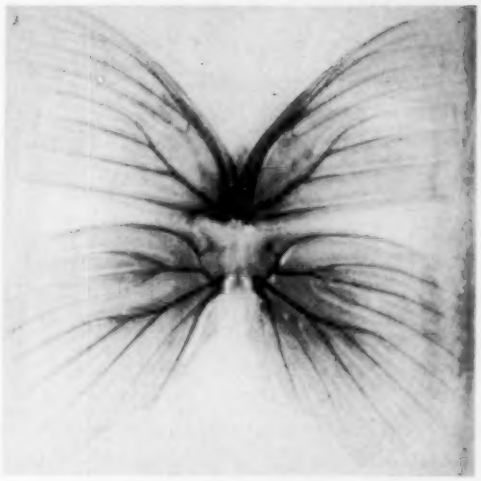

FIG. 2. Neuration of genus *Anaea*. Photograph from glass slide by method described.

When the wings are bleached, put them in fifty per cent alcohol for five minutes; this is to remove the water and excess bleaching agent.

The wing should now be washed in seventy-five per cent alcohol, and then in ninety-five per cent alcohol. When the wings have been thoroughly washed, put them in xylol to clear.

After the wings have become clear, they may be mounted upon a glass slide,

cut large enough to take care of the specimen, in a drop of thin balsam. The mount should then be covered with cellophane and secured with cellophane tape. Wings bleached and mounted in this way make an important addition to a collection. The slides should be carefully labeled to correspond with other mounts in a collection.

The wings thus prepared may be photographed, and any number may be made for use in class work.

OCTOBER MAGAZINES NEEDED

Due to the continued receipt of new memberships, the secretary is running short of the *October 1944* number. If any who read this have copies that you are not saving, which are in suitable condition for future new members, would you please send them to me?

M. A. Russell, Secretary
403 California,
Royal Oak, Michigan

Tell It with Photos

W. J. SUMPSTINE
Bethany College, Bethany, West Virginia

If you happen to own a micro-projector, it can readily be used as an efficient means for the making of microphotographs without the time-consuming and expensive method of first producing negatives on gelatin or glass and then printing from these.

The only equipment needed in addition to the projector, is projection paper (ordinary photograph contact printing paper will work), developer and fixing bath. The micro-projector is taken into the darkroom, microscope slides selected of the material desired for photographing, and you are ready for work.

Fig. 1. Section of the wing of the common house-fly, magnified about 35 diameters.

Place the slide in the projector and bring the projected image to perfect focus on a sheet of plain white paper. Make sure that your light pattern is of even distribution. Be sure that the image-circle on the paper is slightly smaller than your sheet of sensitive paper. Now snap off the projector light and replace the focusing sheet with the sensitzed paper and prepare for exposure. This sensitive paper must lie perfectly flat. If you are not a dark-room devotee (many biologists are) and do not possess an enlarging board, the paper may be held flat by means of thumbtacks at each corner.

The beginner may waste a few sheets of inexpensive sensitized paper before he discovers the correct exposure time but he is still ahead of the game due to the elimination of the negative.

After exposure the paper is developed, washed, fixed, washed and dried as one

would do in ordinary photoenlarging.

The final product is, of course a negative picture, but in some respects is more suitable for teaching purposes than it would be in the positive form. After the correct exposure time has been determined for any particular microscope slide, many prints can be run off in short order.

If the worker should insist on the final product appearing in the positive form instead of the negative, then the original projection could be made on paper-negative material and subsequent prints produced from these by contact printing.

The two photographs accompanying this article were made by this method.

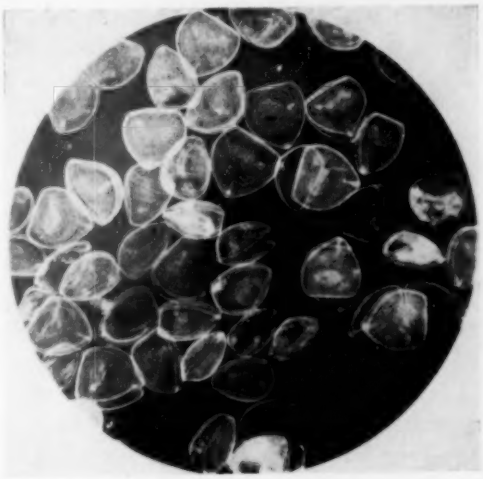

FIG. 2. Clam glochidia, magnification of about 35 diameters.

Current Developments in Science and Biology Teaching

W. F. LOEHWING
Department of Botany, State University of Iowa, Iowa City

Though science and education as a whole are currently and properly geared to the war effort, it is commendable that teachers and administrators are already giving foresighted attention to desirable patterns of postwar instruction and matters of permanent curricular policy. Science education will have to bear its share of the responsibility for vocational rehabilitatian of an unprecedented number of veterans and war workers. America will be confronted with the transfer of the staggering total of 20 million persons from military to civilian pursuits. Since the conversion of industry from a military to a peacetime basis will require time, our schools will be called upon to cushion the collapse of the war boom and to minimize unemployment by re-enrolling several million students whose education has been interrupted. The fact that academic credit will be granted for training and experience in military service will qualify veterans as college matriculants, thus placing a major portion of the responsibility for postwar education upon American colleges and other schools at a comparable educational level.

Biology and its applications will emerge to a more prominent position in peace than in war because the factors of human well-being are intimately entwined with plant and animal science, especially in the realms of agriculture and medicine. The cessation of hostilities will be marked by a subsidence in the mechanized activity of war itself and by a resurgence of interest in human values. The colossal need for humanitarian services is already appallingly evident and it will claim our immediate attention as

soon as the grim business of war is ended. In agriculture alone a host of new workers will have to be trained to meet these needs because the war has decimated the ranks of farm and professional experts and drastically reduced the supply of apprentices in training. To the demands in agriculture must be added the need for trained personnel in nutrition, sanitation, health, recreation, social service work, psychology and psychiatry, to all of which biology is closely related.

It is safe to predict that America will emerge from this war with a firm resolve to improve the health of the nation. Perhaps no feature in the huge mobilization of America's man and woman power for the war has been more disconcerting to the nation than the rejection of approximately 25 per cent of the inductees and the dismissal of an additional 1,200,000 men from military service itself because of physical or mental inability to qualify for active field service. These statistics give an appalling picture of the state of America's health. Unfortunately this condition will be gravely aggravated by an unprecedented number of war casualties. To the list of battle casualties will be added a huge but as yet unpredictable host of diseased bodies and minds. The possibility of epidemics of contagious tropical diseases, which may be introduced on a large scale by returning veterans, is already giving serious concern to medical and public health authorities. In anticipation of some of these heavy demands some provision is already being made for the training of an increased number of medical personnel but little is as yet being done in the realm of agriculture and other phases of biology to meet postwar needs.

The importance of biological education in relation to the above trends is readily evident. The human body is destined to receive more attention in public schools and colleges than ever before. Greater and more widespread knowledge of diet, housing and health will be disseminated in our schools probably to parents as well as to youth. The biology teacher will in the future be called upon to assist much more extensively with the scientific phases of public health and recreation. The state of New York has already assumed leadership in making health instruction mandatory in public schools. Instruction in nutrition will be pointed to improved health and more desirable dietary habits of the nation. Changes in human nutrition will in turn probably lead to certain new practices in agriculture.

Other factors will also affect biology. The rapid expansion of social studies, already under way prior to the war, will receive added impetus from sociological problems arising in the postwar world order. Since our social order deals with living beings and rests largely upon a biological foundation, expansion of instruction in the social sciences is destined to have its impact upon biology as a collateral science. Current interest tends to center increasingly in those phases of biology which underlie legislation on health, housing, nutrition, conservation, agriculture, and medicine. Eminent civic leaders and school administrators have already recommended that biology and science education in general be presented in terms of their bearing on social action.

In connection with educational methods, it may be pointed out that certain as yet inconspicuous but nevertheless widespread tendencies have been gaining ground. There already exists a definite movement in the direction of a balanced earn-learn program. This idea of providing realistic job experience as an integral part of the student's schooling is by no means new and it has long been successfully practiced at the well-known

Berea and Antioch Colleges and more recently at the University of Chicago. The earn-learn program envisages enlarged opportunity for complete or partial self-support and bona fide job experience while the student is in school. The National Youth Administration was started in 1935 as an emergency relief measure for the purpose of removing school-age persons from the labor market by financially subsidizing their return to school. It is interesting to note that by creating an opportunity to earn from five to twelve dollars per month, the N.Y.A. made it possible for 650,000 persons to return to school. The Civilian Conservation Corps also proved to be highly successful as a job-training project and enjoyed about a 40 per cent annual turnover due to acceptance of C.C.C. graduates into permanent employment, as compared to only one per cent for school age youth registered with federal unemployment agencies. The C.C.C. obviously possessed spot value in job training which the public school education lacked. We have the precedence, policy and experience necessary to develop a comprehensive national educational program of this sort on a large scale and to modify it to meet postwar exigencies. Problems similar to those of the prewar depression may again arise with collapse of the present war boom and federal subsidy may again be necessary for education designed to facilitate employability of American youth.

One may ask how this shift in educational method will affect biology. The answer may prove to be that biology will be called upon to prepare more students for gainful employment in its applied phases at technical as well as at professional levels. Formulation of details for such a program may not be difficult in vocational high schools and technical colleges, but real administrative ingenuity may be required to create such projects in our liberal institutions. One immediate problem will be that of the time schedule. Classroom studies may have to be staggered with outside work, perhaps on alternate days of the week. Daily classroom meetings of one hour are poorly adapted to realistic laboratory work in biology. The length of laboratory periods may have to be increased and to a large degree biology courses may be transferred from the laboratory to the greenhouse and the out-of-doors. Such biological information can be given sound scientific values and made more valuable to the student because he acquires information directly instead of through the textbook or lecture. The imperative need for wider information on conservation in all its aspects will also give further impetus to field work with renewed emphasis upon ecology. Despite the informality of method, substantial quantities of sound biological information can be effectively inculcated in the field and laboratory under informal auspices provided teachers have the training and adequate time for proper preparation of study projects. The schedule of courses must also provide periods of time long enough for field work and for completion of biological experiments in the laboratory.

While it is only proper that education should alter its curricula to meet new social needs, it will be necessary for administrators and teachers to safeguard standards and to avoid the assumption that curricular change alone constitutes educational progress. The place which science and biology assume in the new educational order will in large degree be determined by its close correlation with new social developments and by the preparation of a comprehensive program of science instruction supported in a unified way by scientists throughout the nation. The educational and biological

societies of America have the opportunity and the obligation of leadership in placing the talent of science at the disposal of the nation in peace as it has been in war. Our schools and industry stand ready to consider any educational program for science and biology which embodies the consensus of scientists themselves.

Books

MORRIS, PERCY A. *They Hop and Crawl.* The Jaques Cattell Press, Lancaster, Pennsylvania. xiii + 253 pp. Illus. 1944. $3.50.

The author has organized in popular style an extremely concise and well-illustrated book discussing habits, habitats and interesting characteristics of the snakes, lizards, crocodilians, turtles, toads, frogs and salamanders of the United States. Emphasis has been placed on those species occurring east of the Mississippi River. Of the 180 pages devoted to reptiles, 110 are concerned with the poisonous and nonpoisonous snakes.

Much factual data is presented in nontechnical language to show the practical and economical importance of each type of reptile and amphibian discussed. Distribution, food, natural enemies, coloration and reproduction are topics comprising the discussion.

The book is not designed to be a technical reference for the zoologist or herpetologist, rather, it is for the youngsters and adults uninitiated in the field. As one of the humanizing science series, this book would be an asset to every high school library.

There is no bibliography.

TED F. ANDREWS, ART 3/c
Naval Air Technical Training Center, Corpus Christi, Texas

HOAGLAND, DENNIS R. *Lectures on the Inorganic Nutrition of Plants.* The Chronica Botanica Co., Waltham, Mass. G. E. Stechert and Co., New York City. 177 pp. Illus. 1944. $4.00.

This is volume XIV of a "New Series of Plant Science Books" edited by Frans Verdoorn and consists of lectures on Inorganic Plant Nutrition given at Harvard University, under the Prather Lectureship, by the author. Its purpose is to present a general perspective, in highly compact form, of several important problems in the nutrition of higher plants. A dynamic interpretation of the soil system by experimental evidence through the use of stable and radioactive forms of chemical isotopes has been used. Although the treatment is highly technical and probably over the heads of the average biology teacher several lectures are of general interest such as: A Survey of Problems of Plant Nutrition; The Growth of Plants in Artificial Media in Relation to the Study of Plant Nutrition; and the Upward Movement and Distribution of Inorganic Solutes in the Plant. The twenty-eight plates of illustrative material and their analyses and descriptions are taken from the experiences of the author and several groups of California workers and would be more than worth the price of the book for illustrations of the effect of various soil conditions and nutrient solutions.

CHARLES C. HERBST,
Beverly Hills High School, Beverly Hills, California

A Design for General Education, American Council on Education Studies, Series I, No. 18, June 1944, 186 pp., $1.25.

This study includes a detailed outline of the objectives of general education for members of the armed forces and course outlines, some in considerable detail and others only by suggestion. For more than a dozen courses, one of which is biological science. The content of the biology course has been rather severely cut from the usual volume of the typical college course. It has been planned "to stimulate and guide the thinking of the students so that they may acquire appropriate intellectual skills as well as accumulate useful facts."

The outline is as follows: (Numbers in italics in parentheses indicate the relative weights of parts of the outline on the basis of 100 for the whole.)

I. An over-all view of the plant and animal kingdom (*3*)
II. Plants and their importance to man (*23*)
  A. The energy cycle in plants and animals
  B. Conservation of plant resources
III. Reproduction (*10*)
  A. Reproduction in plants and the lower animals
  B. Human reproduction
IV. Human maturation (*3*)
  A. Physical (brief survey)
  B. Psychical
V. Human evolution (*2*)
  A. Genetic variety among living humans (human stocks and races)
  B. Development of the species
VI. The human body (*32*)
  A. The concept of organism
  B. The blood and circulation
  C. The respiratory system
  D. The digestive system
  E. Nutrition and metabolism
  F. Kidney action
  G. Endocrines
  H. The nervous system
VII. Heredity (*20*)

A. The fundamental mechanism of heredity
B. Sex determination and sex-linked heredity
C. Eugenics
VIII. Mechanism of evolution (7)
A. Sources of stability
B. Sources of hereditary variations
C. Sources of guidance (natural selection)

JOHN BREUKELMAN

SMITH, ELLA T. *Exploring Biology.* Harcourt, Brace and Company, New York. 696 pp. 1940.

Learning Exercises and Teaching Helps: Each of the thirty-four problems of the text is accompanied by its own group of activities —abundant and varied in the type of work required of the student—observation, experimentation field trips, reference readings, all being included. For each problem there is one activity the answer to which forms a conclusion to the problem, and this conclusion the student is helped to draw himself. The directions are frequently: 'To test your understanding of the problem. . . ." At the end of each of the nine units, under the title, *Clinching the Unit Idea,* there are directions for preparing a unit summary.

The activities make a definite attempt to teach scientific method, sometimes clearly labelling the particular aspect sought, but often using scientific method implicitly, without calling it such. Reference readings in textbooks and current periodicals are included in the activities.

The end material of the book is complete, containing, for one thing, a fairly complete list of books, magazines, government bulletins, pamphlets, and addresses of scientific supply houses. There is in addition, a glossary and a full index. The table of contents lists all of the units, and all of the problems and selected researches for each unit.

Literary Style: The title *Exploring Biology* accurately expresses the idea behind the text. Every page shows some bits of exploration, and the entire presentation is made in such a way as to lead the student to explore the intricacies of biology.

The selected researches at the end of each unit are well chosen, and show by their development and presentation, as no other means could, that biology is a subject of minute discoveries and infinite study. The activity book is excellently written for student work. The suggestions lead the student on to his own discoveries, and for once the questions are not all answered by the tone of the statement.

The words are well chosen, but there is still present a terrific vocabulary—omnipresent in biology textbooks. The gradual addition of words is most commendable, and it is only in the latter chapters that new words are introduced much faster than they can be assimilated by the students. The idea of a functional vocabulary is most interesting, and the author does very well in holding it down to a minimum of new words.

Psychological Soundness: A psychological review of this book proves the axiom that one must not be too hasty in judging, after a superficial examination or by looking at a book's cover. Leafing through the book gives one no impression. Upon further, more careful examination, features emerge which are a challenge to any biology instructor interested in real teaching.

Contained within the text is an abundance of scientifically sound, psychologically rich, material. It starts a student off in the right direction and provides an abundance of interesting reading material and biologic activities. It thus also provides the instructor with teaching leads of incalculable value. Psychologically, it will reach the slower student and yet will also provide the rapid learners with extra, valuable experiences with Nature.

Mechanical Make-Up: The cover consists of a heavy grained 5½ by 8¾ inch blue-yellow microscope design. The inner cover has a most effective pictographic motif. A dull white paper is used with an average nondistinctive typography. The book possesses a superb series of pictographs, a novel device for secondary biology texts, and is further enhanced by a pleasant effective sequence of drawings by Mr. Marion Cox. An interesting silhouettegraph introduces each unit and one finds an asset in the bold typed numbers before each halftone. Few of the halftones match the dramatic and visual instruction of the pictograph.

Subject Matter: There are nine units covering Heredity, Breeding, Evolution, Reproduction, Health (nutrition and endoctrinology), Interdependence of Living Things, Oxygen and Food Physiology, Classification, Cell Study.

ALAN A. NATHANS (Chairman) New York
MARION RICHTER, New York
MILLIARD BOSWORTH, Vermont
ALFRED NOVAK, Illinois

RECENT PUBLICATIONS

The School Health Program, School Health Monograph No. 12, Welfare Division Metropolitan Life Insurance Company, New York, 1944, 24 pp.

A brief outline of the part the teacher can play in a health program in the school, with applications to the home and community.

First Steps in Health Education (A Guide), Metropolitan Life Insurance Company, New York, 1944, 32 pp.

Material for nursery school, kindergarten and primary teachers: dress, food, safety, disease prevention, sleep and rest.

CARLSON, A. J., *Some Obstacles in the Path Towards an Optimum Diet*, Science, Vol. 97, Nos. 2522 and 2523, 1943, pp. 385–390 and 412–416.

The obstacles are discussed under the following headings: Insufficient knowledge, diseases, food habits, advertising, food processing, waste, poverty, appetite, alcoholism, shortsighted laws, wishful thinking.

Biology and Human Affairs, British Social Hygiene Council, London, Vol. 10, No. 1, 1944, 48 pp.

Contains articles on human culture patterns, race and crime, the value of biology in education, chemotherapy, and the vitamins.

Report of the Director, Chicago Natural History Museum (A Continuation of the Report Series of Field Museum of Natural History), 1943, 121 pp., $1.00.

Report of activities, publications, accessions, public relations, and many other phases of this institution. Excellent photographs.

STANDLEY, PAUL C., AND STEYERMARK, JULIAN A., *Studies of Central American Plants—III, IV*, and *V*, Botanical Series Field Museum of Natural History, Vol. 23, Nos. 1, 2, and 3, 1943 and 1944, pp. 3–28, 31–109, 113–150.

Continuation of a series of descriptions of plants, most of them from Guatemala, collected by various botanical expeditions of the Field Museum of Natural History.

Teaching Kit on Nutrition

This kit, designed for elementary schools, consists of:

(a) *You and Your Engine* by LAURA OFTEDAL, Laboratory Schools, University of Chicago, a thirty-two page nutrition reader for children in the middle grades. It is illustrated in full color.

(b) A small chart, "The Foods I Eat," to be filled out by each child before reading the book, *You and Your Engine*. This chart will help the teacher in determining where to place emphasis in the nutrition instruction.

(c) A work folder, "My Daily Food Record," printed in full color, to be filled out by each child after reading the above book. This record may be sent home to the parents in an effort to secure their cooperation.

(d) A folder, "Suggestions for Teachers."

Additional copies of any or all pieces in the Kit may be secured from the *National Live Stock and Meat Board*, 407 South Dearborn Street, Chicago 5, Illinois.

HELPING CRIPPLED CHILDREN

The twelfth annual sale of Easter seals for crippled children, sponsored by the NATIONAL SOCIETY FOR CRIPPLED CHILDREN and its affiliated organizations, will be conducted this year from March 1 to April 1.

About to emerge victoriously from a war for the rights of humanity, it is pleasant to be reminded of what some of those rights are, and one such reminder arrives with our envelope of gayly colored Easter seals, which help finance a program for the care and education of crippled children in our community and in the nation.

One of the important activities being financed by the sale of Easter seals this year is a study which was initiated by the National Society for Crippled Children to gather data regarding the problem of convalescent care. The study is being carried out on a nationwide basis under the direction of a committee of professional persons headed by Dr. A. L. Van Horn, of the United States Children's Bureau.

The committee has retained Miss Kathleen Allen, Washington, D. C., to direct the study on a full-time basis. The committee will examine the needs in convalescent care for the crippled in this country; the coordination of hospital treatment and hospital care; the physical effect of long bed rest; the use of activity and recreation during convalescence, and the social effect of institutional residence. It will attempt to define convalescence for (a) ordinary medical and surgical cases; (b) chronic patients; (c) those needing vocational therapy. The study will encompass the convalescent needs of children suffering from a variety of handicaps, not those alone who are suffering from orthopedic deviations. Special attention will be given to patients suffering from rheumatic fever.

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Programs

At the meeting of October 6, a member of the Medical Corps of the United States Army talked on the subject *Health Problems That Can Be Expected as a Result of Demobilization.* One hundred twenty-five were present to hear the address.

On November 3, Lt. Gortner, United States Navy, spoke on *Mass Feeding Experiments Conducted at Shore Bases of the Navy.*

December 1, a joint meeting was held with the social studies teachers, at which Dr. H. L. Shapiro gave a report on population studies.

CHICAGO BIOLOGY ROUND TABLE

The Chicago Biology Round Table met at the Central Y.M.C.A. for the opening meeting of the school year, for a lecture by Dr. Ethel Alpenfels, on the subject *Anthropology and the Race.* The meeting was attended by 60 people, of whom 37 were members.

The Round Table holds regular meetings throughout the school year. The officers for the current year are as follows:
President: Mrs. Goldia Howes, Morgan Park High School, Chicago.
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Secretary-Treasurer: Miss Ruth Rink, Senn High School, Chicago.
Corresponding Secretary: Miss May H. Kinsey, Harper High School, Chicago.

Biological Briefs

Peller, Sigismund. *Race, Stock and Environment in Human Cancer.* Journal of Heredity 35: 175–181. June, 1944.

The author criticizes the validity of a recent report on a United States Public Health Service survey of the incidence and morbidity of cancer in the whites and blacks in the North, South, and West. He believes that Negroes do not have a lower incidence of cancer than whites, but rather a different organ distribution of the primary tumors. In many cases he believes that regional differences in the occurrence of cancer may partly be due to environmental factors; for example, greater exposure to sunlight may account for the higher incidence of skin cancer among southern whites than among northern ones. The opinion is advanced that factors tending to bring on cancer of a specific organ do not raise the total incidence of cancer in the persons thus exposed, but merely insure its localization when it does occur. The author therefore proposes that an early provoked and easily cured immunizing skin cancer might be induced in individuals whose heredity indicates the likelihood of death from internal cancer.

Wing, Andrew S. *What Makes Your Garden Grow?* Nature Magazine 37: 202–204; 216. April, 1944.

There is a current revival of interest in the soil and its problems; it pays to know the "why" and "how" of soil management. The soil's origin largely determines its nature: sandy if near a shore, clayey, gravelly, or loamy if of glacial origin; black with organic matter if once lake-bottom or prairie, fertile though inorganic if of volcanic dust. Limestone soil is "sweet," granitic soils "sour." If the garden is to be on new soil, the character of the vegetation on it will provide a clue. Otherwise, testing for acidity and for vital soil elements is important. If it is inconvenient to have a nearby government agency provide a soil analysis, adequate testing kits for amateurs are available. Litmus paper in a moist ball of soil provides a rough test for acidity. Although most plants except legumes prefer slight acidity, liming will be needed if the soil is strongly acid. Unless a cheap and abundant supply of manure is available, it will probably be found convenient to supplement organic fertilizer with chemical nutrients. It is most practical to concentrate the fertilizer around the plants, even using a balanced "starter" solution when young plants are set out. The author believes that turning over the soil to at least a spade's depth is necessary for proper vegetable growth.

Moldenke, Harold N. *Rubber; New Sources of Rubber.* Natural History 52: 182–191. November, 1943. *Ibid.* 52: 226–232. December, 1943.

The most important of all sources of rubber is the Pará rubber tree (*Hevea brasiliensis*) which is now being sought growing in the wild state in the Amazon basin. In addition, seeds and seedlings brought out of the Far East before the Japanese invasion are being propagated and budded as rapidly as possible in 12 tropical American countries. A concerted and far-reaching program is seeking to raise the level of American production as fast as possible. *Hevea* gives the greatest yield of rubber because it can be tapped every other day during the season, the bark being removed so

gradually that the same surface is cut only once in 6 or 7 years. In Central America, old trees of *Castilla elastica* and *C. panamensis* may be tapped 2 or 3 times yearly for a fairly good yield.

From the mountains of Central Asia comes the Russian dandelion, *Taraxacum koksaghyz* (from the native name meaning "chewing-root") whose roots yield as much as 20% of rubber. It may be harvested in 6 to 12 months and is being experimentally cultivated in this country. Its optimum range seems to coincide with the areas where sugar-beets are grown, and it may also be processed in beet-sugar refineries. Guayule (*Parthenium argentatum*) rubber has been in commercial production in Mexico since 1904, but it is only in the past few years that the plant has been improved and grown under cultivation in our Southwest. It is harvested and ground to extract the rubber after 4 years of growth. At present, its production is limited because of a greater need for food in the same agricultural areas, but seeds and seedlings for 100,000 acres are now at hand. Long cultivated as an ornamental, the Madagascar vine, *Cryptostegia*, may be an important source of latex. Grown in frost-free areas, most extensively at present in Haiti, after a year's undisturbed growth its leaves and stems may be regularly and severely pruned for their rubber content, or the stems may be tapped every two days. Chrysil rubber, from the many species of rabbit-brush (*Chrysothamnus*) common in Western waste-lands, may be of value in emergencies as a rather inferior type. Chilte rubber, from the genus *Cnidoscolus* of the spurge family, may also prove useful. Also of great value as rubber substitutes are norepol, from soy-bean oil, and a similar synthetic product from corn oil.

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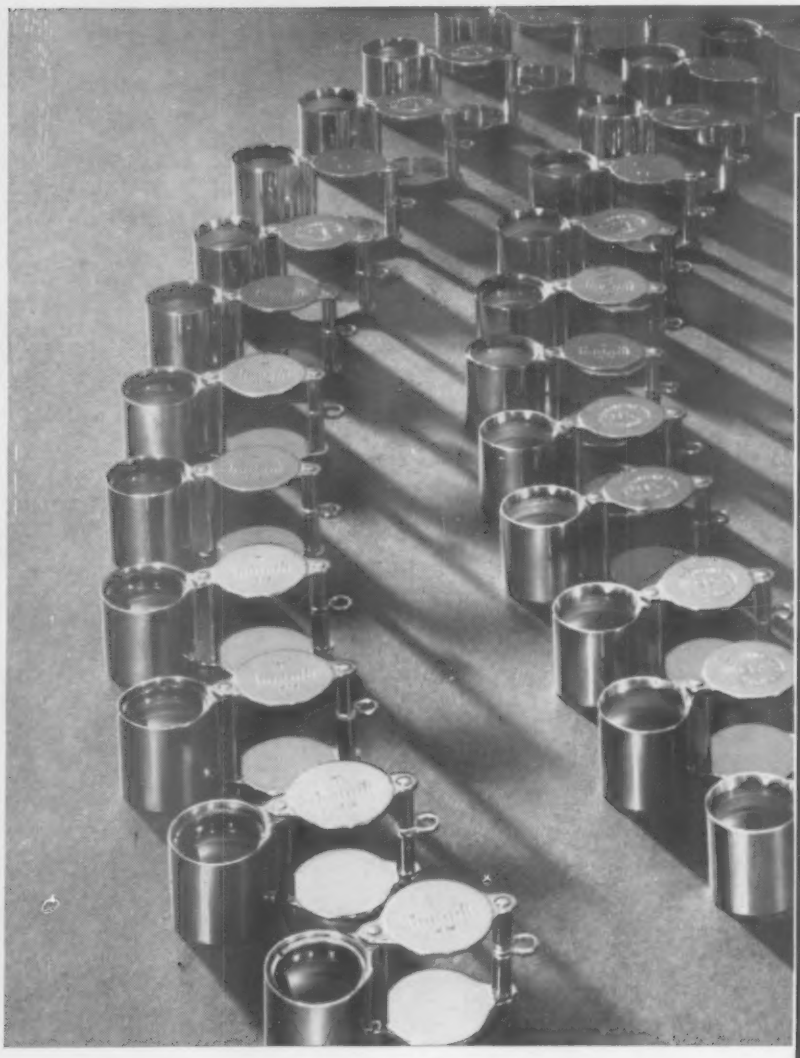

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